Claims

1. A method for dynamic blind signal separation including processing signals associated with windows of data characterised in that the method includes:

a) for pairs of successive windows, each pair having a leading window and a following window, processing the following window using results obtained in connection with each leading window to implement separate initialisation of orthogonality and independence of signals associated with the respective following window and obtain approximate results for the following window, and

b) processing the approximate results to achieve signal separation.

2. A method according to Claim 1 characterised in that processing of the approximate results incorporates updating orthogonality using small updates to produce decorrelation in a second order statistics procedure.

3. A method according to Claim 2 characterised in that updating orthogonality is implemented by a technique referred to as Jacobi and involving diagonalisation of a symmetric matrix by determining and applying rotations iteratively until off-diagonal elements of the matrix become substantially equal to zero.

4. A method according to Claim 3 characterised in that it includes a second stage of initialisation using results obtained for each leading window to initialise independence of decorrelated signals associated with the respective following window, this second stage using independent component analysis (ICA) to apply small rotation updates to initialised signals in a higher than second order statistics procedure to produce signal independence and separation.

5. A method according to Claim 4 characterised in that the higher than second order statistics procedure is at least one of a third order and a fourth order statistics procedure.

6. A method according to Claim 1 characterised in that it is implemented in an acquisition phase in which signals are separated and desired signals are identified among the separated signals, and in a subsequent phase in which only desired signals are processed to separation.

7. A method according to Claim 1 characterised in that the signals associated with windows are statistical measures of data in the windows.

8. A method according to Claim 1 characterised in that it comprises an acquisition stage of processing a first leading window of data to obtain first results, and a subsequent stage of processing following windows by iteratively updating immediately preceding results using subsequent data snapshots to produce snapshot results and combining the snapshot results with the immediately preceding results, the immediately preceding results being those obtained in a respective immediately preceding update if any and being the first results otherwise.

9. A method according to Claim 8 characterised in that prior to combining the snapshot results with the immediately preceding results, the immediately preceding results are weighted with a forget factor to implement an exponentially fading following window

10. A method according to Claim 8 characterised in that the first results comprise a mean vector of signal samples and a covariance matrix of a data matrix of the first leading window in each case, and decorrelation and normalisation of the data matrix to obtain signal vectors from which to obtain their moment as a fourth order tensor.

11. A method according to Claim 8 characterised in that the snapshot results comprise a mean snapshot vector and a snapshot covariance matrix, a decorrelated and normalised snapshot equivalent providing signal vectors from which to obtain their moment as a fourth order tensor update, and prior to combining the snapshot results with the immediately preceding results, the snapshot results are weighted by a forget factor p and the immediately preceding results are weighted by a further forget factor (1-p) to implement an exponentially fading window, where $0 < p < 1$.

12. Computer apparatus for dynamic blind signal separation programmed to process signals associated with windows of data characterised in that the computer apparatus is also programmed to:

a) process pairs of successive windows, each pair having a leading window and a following window,

b) use results obtained in connection with each leading window to implement separate initialisation of orthogonality and independence of signals associated with the respective following window and obtain approximate results for the following window, and

c) processing the approximate results to achieve signal separation.

13. Computer apparatus according to Claim 12 characterised in that it is programmed to update orthogonality of the approximate results using small updates to produce decorrelation in a second order statistics procedure.

14. Computer apparatus according to Claim 13 characterised in that it is programmed to update orthogonality by a technique referred to as Jacobi and involving diagonalisation of a symmetric matrix by determining and applying rotations iteratively until off-diagonal elements of the matrix become substantially equal to zero.

15. Computer apparatus according to Claim 14 characterised in that it is programmed to implement a second stage of initialisation using results obtained for each leading window to initialise independence of decorrelated data associated with the respective following window, this second stage involving ICA to apply small rotation updates to initialised data in a higher than second order statistics procedure to produce signal independence and separation.

16. Computer apparatus according to Claim 15 characterised in that the higher than second order statistics procedure is at least one of a third order and a fourth order statistics procedure.

17. Computer apparatus according to Claim 12 characterised in that it is programmed to implement an acquisition phase in which signals are separated and desired signals are identified among the separated signals, and a subsequent phase in which only desired signals are processed to separation.

18. Computer apparatus according to Claim 12 characterised in that the signals associated with windows are statistical measures of data in the windows.

19. Computer apparatus according to Claim 12 characterised in that it is programmed to implement an acquisition stage of processing a first leading window of data to obtain first results, and a subsequent stage of processing following windows by iteratively updating immediately preceding results using subsequent data snapshots to produce snapshot results and combining the snapshot results with the immediately preceding results, the immediately preceding results being those obtained in a respective immediately preceding update if any and being the first results otherwise.

20. Computer apparatus according to Claim 19 characterised in that it is programmed to implement an exponentially fading following window by weighting the immediately preceding results with a forget factor prior to combining the snapshot results with the immediately preceding results.

21. Computer apparatus according to Claim 19 characterised in that the first results comprise a mean vector of signal samples and a covariance matrix of a data matrix of the first leading window in each case, and decorrelation and normalisation of the data matrix to obtain signal vectors from which to obtain their moment as a fourth order tensor.

22. Computer apparatus according to Claim 19 characterised in that the snapshot results comprise a mean snapshot vector and a snapshot covariance matrix, and the computer apparatus is programmed to produce a decorrelated and normalised snapshot equivalent and to obtain therefrom signal vectors and their moment as a fourth order tensor update, to weight the snapshot results by a forget factor p and the immediately preceding results by a further forget factor (1-p) to implement an exponentially fading window, where $0 < p < 1$, and to implement such weighting prior to combining the snapshot results with the immediately preceding results.

23. Computer software for dynamic blind signal separation including processing signals associated with windows of data characterised in that the software has instructions for controlling computer apparatus to:

a) process pairs of successive windows, each pair having a leading window and a following window,

b) use results obtained in connection with each leading window to implement separate initialisation of orthogonality and independence of signals

associated with the respective following window and obtain approximate results for the following window, and

c) processing the approximate results to achieve signal separation.

24. Computer software according to Claim 23 characterised in that it includes instructions for processing the approximate results using small updates to update orthogonality and produce decorrelation in a second order statistics procedure.

25. Computer software according to Claim 24 characterised in that it includes instructions for updating orthogonality by a technique referred to as Jacobi and involving diagonalisation of a symmetric matrix by determining and applying rotations iteratively until off-diagonal elements of the matrix become substantially equal to zero.

26. Computer software according to Claim 24 characterised in that it includes instructions for implementing a second stage of initialisation using results obtained for each leading window to initialise independence of decorrelated data associated with the respective following window, this second stage using ICA to apply small rotation updates to initialised data in a higher than second order statistics procedure to produce signal independence and separation.

27. Computer software according to Claim 26 characterised in that the higher than second order statistics procedure is at least one of a third order and a fourth order statistics procedure.

28. Computer software according to Claim 23 characterised in that it includes instructions for implementing an acquisition phase in which signals are separated and desired signals are identified among the separated signals, and a subsequent phase in which only desired signals are processed to separation.

29. Computer software according to Claim 23 characterised in that the signals associated with windows are statistical measures of data in the windows.

30. Computer software according to Claim 23 characterised in that it includes instructions for implementing an acquisition stage of processing a first leading window of data to obtain first results, and a subsequent stage of processing

following windows by iteratively updating immediately preceding results using subsequent data snapshots to produce snapshot results and combining the snapshot results with the immediately preceding results, the immediately preceding results being those obtained in a respective immediately preceding update if any and being the first results otherwise.

31. Computer software according to Claim 30 characterised in that it includes instructions for implementing an exponentially fading following window by weighting the immediately preceding results with a forget factor prior to combining the snapshot results with the immediately preceding results.

32. Computer software according to Claim 30 characterised in that the first results comprise a mean vector of signal samples and a covariance matrix of a data matrix of the first leading window in each case, and decorrelation and normalisation of the data matrix to obtain signal vectors from which to obtain their moment as a fourth order tensor.

33. Computer software according to Claim 30 characterised in that the snapshot results comprise a mean snapshot vector and a snapshot covariance matrix, and the computer software includes instructions for producing a decorrelated and normalised snapshot equivalent and for obtaining therefrom signal vectors and their moment as a fourth order tensor update, and for weighting the snapshot results by a forget factor p and the immediately preceding results by a further forget factor (1-p) to implement an exponentially fading window, where $0 < p < 1$, such weighting being prior to combining the snapshot results with the immediately preceding results.